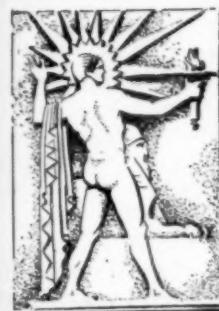


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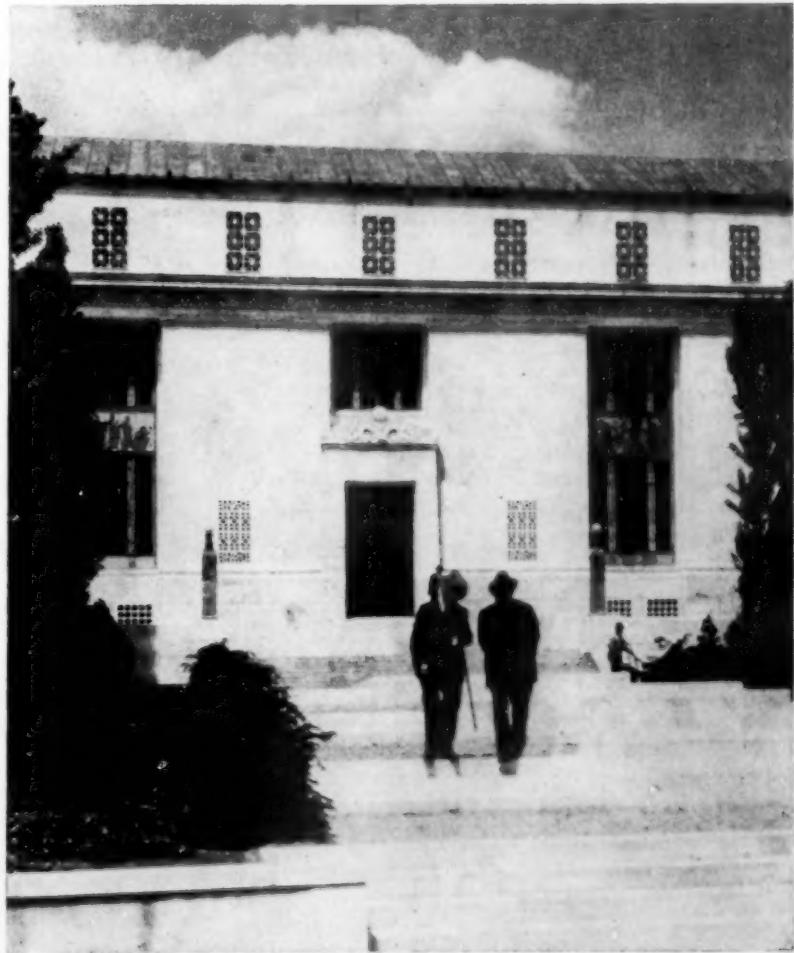


# SCIENCE NEWS-LETTER

*The Weekly Summary of Current Science*  
A SCIENCE SERVICE PUBLICATION

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April 28, 1928



## A PANTHEON OF SCIENCE

(See page 258)

Vol. XIII

No. 888

# Common Chemical Seasickness Remedy

Medicine

Seasickness may cease to be the voyager's bugbear if experiments of Drs. J. Frank Pearcy and Daniel Hayden of Chicago are substantiated by further tests.

The possibilities of the new remedy came to light when the doctors were making experiments to determine the depressant effect of the common drug, sodium nitrite, on the mechanism of the middle ear that controls the balancing of the human body, they stated in a report of their work to the American Medical Association.

"Believing that seasickness is due mostly, if not completely," they explained, "to overstimulation of the vestibule (of the middle ear), we felt that the nitrites offered a direct attack at the long-sought but never attained cure for the terrible malady

of the ocean voyage."

So when Dr. Hayden was about to take a trip abroad he sought to put his theory to the test, but none of the passengers on the trip going over the Atlantic accommodated by becoming ill. On the return voyage, however, he had better luck. Sixteen succumbed and were divided into two groups of eight each, one of which received the nitrite treatment while the others were kept under observation as controls. Every attempt was made to have patients with equally acute symptoms in each group.

The controls were prostrated for about two days, but the others who received from three to five grains of sodium nitrite every two hours until they were relieved were comfortable on deck and able to eat meals in

four hours. There was no recurrence of symptoms.

"Although the work has a sound experimental basis," they declared, "the actual tests having been adequately controlled and 100 per cent. cures obtained, we expect to use nitrites in a much greater series before drawing final conclusions. We are certain that they will cure many cases of seasickness but it is possible that there are cases that will not be cured."

Sodium nitrite is a common chemical, which comes as white sticks or granules. It has long been used by physicians in the treatment of angina pectoris, dropsy and several other diseases. It should not be experimented with, however, except under professional advice and supervision.

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## A Pantheon of Science

General Science

The Building of the National Academy of Sciences and the National Research Council, which is also the home of Science Service, has been the scene during the past week of the annual spring meeting of the National Academy, whose proceedings are reported elsewhere in this issue.

This building, which is one of the masterpieces of the architectural genius of the late Bertram Grosvenor Goodhue, is universally acknowledged to be a creation of unique beauty in Washington, which is a city of beautiful structures. In its general outline it is simple as its austere and majestic neighbor, the Lincoln Memorial; but when one comes to look at it more nearly and at leisure, one comes upon an endless fund of carefully wrought detail, every item be-speaking the combination of richness and deliberate restraint that is the mark of a well-tempered finely-edged civilization.

In addition to its functions of providing a fit setting for the meetings of the National Academy of Sciences and of housing the multifarious executive and editorial activities of the bodies that are its tenants, the building offers to the wayfaring man the hospitality of a museum of the latest scientific apparatus, so arranged and labeled that even the least learned can operate and understand each exhibit.

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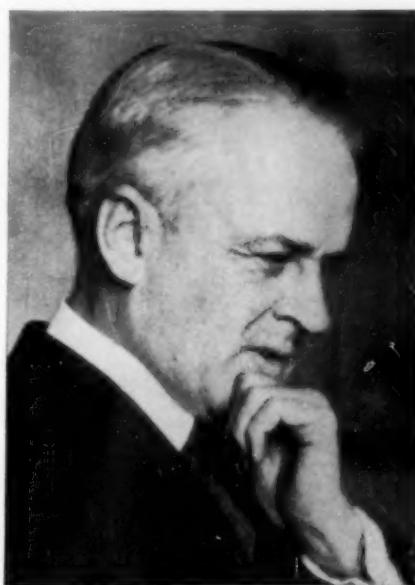
All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

# Cosmic Rays Signal Matter's Creation

*Physics*

Somewhere out in the reaches of the stellar universe, chemical elements, like oxygen, silicon, and iron, common here on earth, and helium, abundant in the heavens, are being made. First evidences of the wholesale continuous creation of matter were presented by Dr. Robert Andrews Millikan, Nobel prize winner and California physicist, in a leading address to the National Academy of Sciences meeting at Washington. Cosmic rays, oscillating a hundred times more rapidly than the most powerful rays hitherto known, are given off when the matter is formed and they brought the news to earth to be detected by Dr. Millikan and his associate, Dr. G. Harvey Cameron. The stuff out of which these elements are made are primordial electrons, the positive ones which are the nuclei or hearts of the simplest of the elements, hydrogen, and the negative ones which are the essence of electricity.

This startling discovery of the creation of matter long desired in the theoretical thinking of physicists, arose from the discovery last fall that the cosmic ray spectrum is not continuous, like the visible light, but banded. The highest frequency or shortest wavelength band has so enormous a penetrating power that it passes through 200 feet of water or 18 feet of lead before being absorbed. Dr. Millikan and his fellow physicists sent balloons miles high in the air, probed the depths of mountain lakes and climbed the Andes while discovering the properties of the strange and powerful



DR. R. A. MILLIKAN, Nobel Prize winner, Director of the Norman Bridge Laboratory of the California Institute of Technology, Pasadena, who told the members of the National Academy of Sciences of his newly developed proofs of the continual creation of matter in outer space

radiation from outer space.

Using Einstein's special theory of relativity, which Dr. Millikan declared never "thus far shown to be incorrect," the physicists showed that there are no possible atomic transformation capable of yielding the cosmic rays except the actual building up or creation of the abundant elements, helium, oxygen, silicon and iron out of hydrogen, or silicon and iron out of helium. The actual

frequencies of the three bands in the cosmic ray spectrum were found to correspond closely with those determined theoretically. Moreover since these elements are the most plentiful in the universe and the other rarer elements are created much less frequently and vigorously, there is reason to believe that nearly the whole elemental story of universal creation is told in the cosmic rays.

The secret of the powerful cosmic rays is contained in the loss of a minute amount of the mass of hydrogen atom when it combines with other hydrogen atoms to form the heavier elements. Eight thousandths of its mass goes off in the form of cosmic rays. Similarly when other elements are built a small fraction of their weight is transmuted into radiant energy and is shot out into the universe. The cosmic rays are signals of the continual rebirth of the universe.

At the same session of the National Academy, Dr. I. S. Bowen, one of Dr. Millikan's associate's at the California Institute of Technology, relieved scientists of the necessity of looking for a hypothetical element, nebulium, attributed to the nebulae or star clouds of the heavens because of presence of qualities in their light that could not be blamed upon any known elements. He announced that oxygen and nitrogen in these far parts of the universe act differently than they do on earth and can produce the effects attributed to nebulium.

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## Dr. Millikan's Own Statement

*Physics*

The formal scientific publication of Dr. Millikan's latest conclusions as to the origin of cosmic rays has not yet been made in a technical scientific journal, but Dr. Millikan has prepared for Science Service the following statement of his work which was done jointly with Dr. G. Harvey Cameron.

The evidence that the more stable and more abundant elements like helium (abundant in the heavens), oxygen, silicon and iron, are being formed at the present time out of the primordial positive and negative electrons, the former of which is the nucleus of the hydrogen atom, may be briefly summarized as follows:

First, the pilot balloon experiments of Millikan and Bowen, in which

they sent up recording electroscopes .92 of the way to the top of the atmosphere, and in which the absorption coefficient of the cosmic rays at or near the top of the atmosphere come out of the same order of magnitude as that found near sea-level, show conclusively that these rays consist of a definite and distinct region of spectral frequencies, or oscillations, a hundred times more rapid than those produced by the most powerful subatomic changes heretofore known, namely those accompanying radioactive changes.

Second. The experiments of Milli-

kan and Cameron of the last summer and fall made in deep, high-altitude California lakes, with new electroscopes ten times more sensitive than those the authors had theretofore used, brought to light the definite proof that the cosmic ray spectrum consists of definite bands like those of neon or mercury lamps containing spectral lines as much as three octaves apart. The highest frequency band having so enormous a penetrating power that it passes through as much as 200 feet of water (equivalent to 18 feet of lead) before becoming completely absorbed. This (Turn to next page)

# Botany and Religion

*Botany*

DR. A. F. WOOD, of the U. S. Department of Agriculture, in an address before the Mt. Pleasant Congregational Church, Washington:

Religion viewed from the standpoint of science is a generic term that applies to a psychological state of an individual or group of individuals in relation to supernatural power. It may in its narrower sense be understood as a body of belief in reference to such power or it may emphasize procedures connected with the relation of the individual or group to such power, or it may include all these aspects. All are involved in the development and evolution of the religious sense in man and must be studied by the psychologist and anthropologist if a clear understanding of man in his totality is to be secured.

When primitive man began to ask questions and to find or invent answers to them he began his relations to higher power and intelligence. Perhaps the developing child is as good an illustration as any of the gradual race development step by step in this respect. It is in a measure a recapitulation of psychological race history. The love of

legend, and of mystery, fairies, gnomes, elves, giants, fair ladies, and princes is a part of this development in every normal child of all races. It dates back to the days of race intellectual childhood, when all unknown manifestations of power were attributed to some living personality, unseen, connected with the object. These were good or bad according to the relation of the manifestation to the welfare of the individual or the tribe.

The origin of many curious beliefs and customs can be traced to what are now well-known phenomena. The lower organisms causing disease are the evil spirits that caused it in the olden times. That these might be passed on from one afflicted to others is now the well-known contagion and infection.

Whatever the evil spirit may be it is associated with bacteria or protozoa, and these are legion, just as dangerous as our forefathers thought they were, *and they are living things*.

Ancient tree worship, as the belief in druids in England, and the spirits in the grain, a common belief among many primitive tribes, was a recognition of *something living* in plants.

sometimes helpful, sometimes destructive. The proper recognition and treatment of these spirits, good and bad, was a matter of life and death and appealed very strongly to the primitive mind.

Our knowledge of plant life today places these phenomena in their right relation. The causes of bountiful harvest or famine are well known and can be in a measure controlled. While there is still that mysterious life we can study the laws of its action and its relation to environment. We can see it struggling upward in the scale of being and we are acquiring increasing awareness of wonderful powers in the universe that we do not understand. We are impressed more and more with the reign of law. Action and reaction, cause and effect, progress and degeneration, life and death—all a series of adjustments, transformations, leading on to higher or lower levels, as the case may be. Life manifestation passes from its simplest state, where it is almost if not completely controlled by environment, to the other end of the ladder, where it almost if not quite controls its environment.

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## Dr. Millikan's Own Statement—Continued

discovery of a banded structure in the cosmic rays shows that they are not produced as are X-rays by the impact upon the atoms of matter of electrons which have acquired large velocities by falling through powerful electrical fields—the fields needed to produce frequencies of the order of the cosmic rays would be at least 150,000,000 volts (3000 times as great as the field existing in X-ray tubes)—but that they are rather produced by definite and continually recurring atomic transformations involving very much greater energy-changes than any occurring in radioactive processes.

Third. If the Einstein special theory of relativity may be taken as a sound basis of reasoning—and no results predicted by it have ever thus far been shown to be incorrect, while it has many striking successes to its credit—then it follows that radiant energy can never escape from an atomic system without the disappearance of an equivalent amount of mass from that system. These relations being contained in the well-known equation of Einstein  $MC^2=E$ , where

$M$ =mass in grams,  $C$  is the velocity of light in centimeters and  $E$ =energy ergs. Now, through recent very exact work of Aston's, we know the mass of every one of the atoms with a great deal of certainty, and we can, therefore, compute the amount of ether-wave energy that can be generated by any sort of atomic transformation that can take place, and, knowing this energy, we can compute with the aid of quite reliable formulae the frequency and the penetrating power of any rays resulting from all possible atomic transformations. Such studies reveal the fact that there are no possible transformations capable of yielding rays of the enormous penetrating power observed by Millikan and Cameron except those corresponding to the *building up*, or creation of the abundant elements like helium, oxygen, silicon and iron out of hydrogen, or in the case of the last two elements out of helium. The entire annihilation of hydrogen by the falling completely together of its positive and negative electrons might be an additional possibility, but it can be eliminated in this case for two excellent

reasons. The qualitative evidence is, therefore, scarcely escapable that the powerful cosmic rays here studied are produced by this very act of the creation of the common elements out of the primordial elements.

Fourth. The evidence herewith obtained is, however, fairly accurately quantitative, not merely qualitative. For Millikan and Cameron analyzed their cosmic ray curve empirically before they had called on any theoretical considerations whatever, and reported in scientific papers that their observed curve demanded three cosmic ray bands of absorption coefficients .35, .08 and .04 per meter of water, respectively. They afterward computed from the foregoing considerations what the theoretical absorption coefficients would be if their observed cosmic rays were produced by (1) the formation of helium out of hydrogen (2) the formation of oxygen out of hydrogen and (3) the formation of silicon out of hydrogen. The results came .32, .075, and .043, well within the limits of uncertainty of their analysis of their curve.

*Science News-Letter, April 28, 1928*

# Earthquake Recorders, Rays and Radio

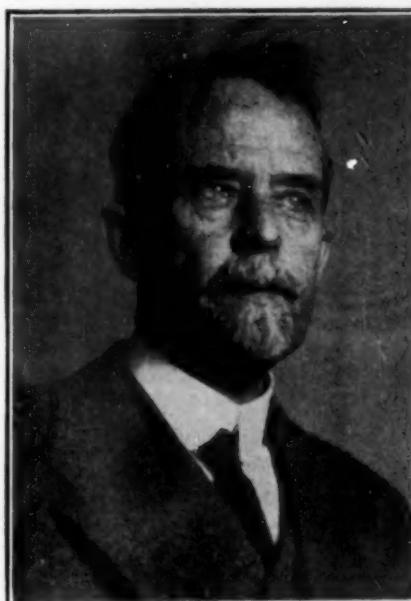
General Science

The National Academy of Sciences, founded during the administration of President Lincoln, met in Washington on April 23, 24 and 25. A part of the proceedings of this body, which is in a way the Senate of American science, are reported here. Further reports will be given in the SCIENCE NEWS-LETTER for May 5.

A new type of seismometer, or earthquake measurer, that has already proven its utility by records of the earthquake in Bulgaria on April 14 and other recent quakes, was shown by its inventor, Dr. Frank Wenner, physicist at the U. S. Bureau of Standards. Earthquake experts hail the new instrument as a great improvement over earlier types, and the U. S. Coast and Geodetic Survey is planning to install the Wenner seismometer at one or more of its earthquake observatories.

The new seismometer depends upon the fact that when a coil of wire moves in relation to the field of a magnet, an electric current passes through the wire. This principle is used in electric dynamos. It was also applied to the recording of earthquakes by a Russian nobleman, Baron Galitzin, in a form of instrument used in some modern observatories. A pendulum-like device supports the coil, the magnets are on the ground. As the ground shakes, even though very slightly because of the earthquake waves, the pendulum remains stationary. The relative motion of the magnets and the coil produces a minute electric current, which passes through a delicate galvanometer. Here the current causes a tiny mirror to turn, and a reflected spot of light moves across a moving strip of photographic paper. When the paper is developed there appears on it a wavy black line, the autograph of the earthquake, which to the seismologist reveals the quake's complete history.

Dr. Wenner has employed a similar principle, but has made important improvements in the instrument's design. It is estimated that it can be installed for about a seventh the cost of the Galitzin apparatus, and it does not require unusual skill to keep in operation. The record obtained with the Galitzin device is quite different from that of earlier types of instrument, where the hanging mass makes a direct record on smoked paper. Dr. Wenner says that his instrument gives a record that is essentially the same as if the tiny mirror were directly attached to the mass. Another advantage is that the seismometer proper can be in a vault at some dis-



PROF. THOMAS HUNT MORGAN, internationally known biologist and President of the National Academy of Sciences

tance from the recording apparatus, from which the adjustments and tests can be made.

## Ultra-Violet Light and Radio

The sun's ultra-violet light, consisting of waves too short to be seen with the eye, and which prevents the occurrence of rickets in children, may also have to be thanked for making radio telegraphy and telephony possible. Dr. E. O. Hulbert, of the U. S. Naval Research Laboratory, announced his theory that the ultra-violet light in the sun alone causes the ionization of the upper layers of the earth's atmosphere. This ionization is associated with the so-called Kennelly-Heaviside layer, which is believed to hold radio waves down close to the earth and preventing them from spreading out into interplanetary space. By successive reflections from this layer radio waves are brought back to the earth, so that the antipodes are able to communicate with each other.

Waves as short as 16 millionths of an inch can be perceived by the eye, but the waves to which Dr. Hulbert ascribes the cause of the ionization are about 5 millionths of an inch in length, or even shorter. He pointed out that this theory was based entirely on known laws of pressure and the constitution of the high atmosphere, and

of the way that atoms lose part of their quota of electrons when they become ionized. Because of the seasonal changes of the upper atmosphere, and the lower altitude of the sun during the winter, ionization in winter time is reduced, and this accounts for the better radio transmission during the cold months. To the daily changes in ionization, with the coming of darkness, is due another change in ionization, and which is responsible for the better night transmission.

Since, he says, a satisfactory theory of this kind must account for what happens to all of the light from the sun, Dr. Hulbert has worked out the fate of all the sun's ultra-violet light. The shortest waves, of lengths less than about 3 millionths of an inch, he says, cause the ions to form in the highest layers of the atmosphere. Part of this causes the aurora borealis. Waves between 3 and 5 millionths of an inch cause the ions at a layer between 90 and 120 miles high in summer, and between 50 and 62 miles in winter. Waves of lengths between 5 and 7 millionths of an inch are absorbed by the oxygen and turn it to ozone, but these and the longer waves do not produce any ions. Waves longer than about 11 millionths of an inch reach the earth's surface, where they cause sunburn and cure rickets.

## World Will Feed Eight Billions

A world population of eight billions can be realized if all the land areas capable of yielding food are put into agriculture, grazing or whatever uses they are best suited for. So Prof. H. L. Shantz of the University of Illinois told members of the National Academy.

"The natural vegetation of the world may be divided into 7 forest types covering a world area of about 22 million square miles, 7 grassland types covering 13 million square miles, and 5 desert types covering 17 million square miles," said Prof. Shantz. "Most of the forests are valuable as timber land but may be converted into agricultural land. Of the 22 million square miles of forest about 14 million square miles are capable of yielding crop producing land. Of this area about 6 millions are suitable for warm weather crops and 8 millions are suitable for cool weather crops.

"There are about 3 million square miles of forest land suitable for grazing only. The (Turn to next page)

## National Academy of Sciences—Continued

grasslands are valuable as grazing lands and of the 13 million square miles of grasslands, 3.5 million square miles are suitable for the production of cool weather crops, such as wheat, rye, oats, while 6.8 million are suitable for warm weather crops, such as cotton or corn, and 2.7 million suitable for grazing only."

The desert types constitute 17 million square miles, Prof. Shantz said, and are useful chiefly as grazing land of low carrying capacity.

"On the basis of the combined types," he continued, "the world contains about 26 million square miles of grazing land, about 12.8 million square miles of land climatically capable of producing warm weather crops, and 11.5 million square miles capable of producing cool weather crops.

"If 2 acres are required for every inhabitant or a population density of 320 per square mile, the agricultural land would support a world population of about 8 billion people."

### Mayan Turquoise Plaque

The plaque of turquoise mosaic recently dug up at the ruined city of Chichen Itza is so valuable and fragile a piece of ancient American art that a museum expert is now enroute from New York to Yucatan on the special mission of restoring the plaque.

How he discovered the plaque and other buried ceremonial treasure in an old Maya temple at Chichen Itza was described in a communication sent to the meeting by Earl Morris, of the Carnegie Institution of Washington. Mr. Morris and other members of the Carnegie Institution's expedition are still at Chichen Itza, engaged in the task of restoring the temple.

Mr. Morris has spent some time searching for the ceremonial treasure which was usually buried under the altar in a Maya temple. Excavations in the floor finally revealed a limestone jar containing the turquoise mosaic disk, which is about the size of a dinner plate, and also a jadeite ball used by the priests in divining, the parts of a necklace, and the bones of a bird.

About 3,500 pieces of turquoise went into the making of the design in the plaque. Two-thirds of the elaborate mosaic pattern is still intact after hundreds of years, held in place by the thin film of adhesive which once stuck the blue stones to a wooden background. This wood is now only a brown powder. The beautiful object, dedicated to the Maya gods, is

today pronounced the finest specimen of delicate craftsmanship ever found in the land of the Maya Indians.

Referring to the plaque, Mr. Morris stated: "The tiny bits of stone composing it probably were mined in Arizona or New Mexico, fashioned and combined into beautiful form in or not far from the Valley of Mexico, then transported through some hundreds of miles of jungle, finally to be sealed away as a dedicatory offering beneath a temple floor."

Only one other turquoise object found in the Maya country could be recalled, it was said today.

### Maya Life-Processes Faster

Maya Indians in Yucatan, descendants of the race that built the great cities that rival the glories of Egypt and Babylon, live faster than white men do. This does not mean that they have Great White Ways, synthetic gin and jazz; on the contrary, they lead about the simplest, healthiest lives that are to be found anywhere on this continent. But certain fundamental physiological processes, involving the chemical taking apart of food, building it into their body tissues, and getting rid of the waste products, they carry on about 7 per cent. faster than do the white men who come to their country to dig up and restore to them the pyramids and palaces of their ancestral glory.

"Basal metabolism" is the collective term for these physiological processes, and it was this that Dr. Francis G. Benedict and Dr. G. D. Williams of the Nutrition Laboratory of the Carnegie Institution of Washington have studied. They reported the results of their researches among the people of Yucatan before the Academy.

The two physiologists measured the basal metabolism of the Maya Indians hired to work in the excavations, and compared it with that of the white men who were hiring them and studying the stones they turned up. They found that the basal metabolism of the whites was about the same in the warm land of Yucatan as it was at home in the United States. A large group of Maya men were found to have a metabolism averaging 7 per cent. above the standards for white men of similar age, weight and height, living in the northern part of the United States. Since the sub-tropical climate might be expected to lower rather than raise the metabolism of these Indians, they state, it is evident

that some other factor, presumably racial, has asserted itself.

### Plants in Artificial Climates

Plants growing in climates made to order, with days anywhere from 5 to 24 hours long, and great batteries of powerful electric lights for suns, were described before the meeting of the Academy by Dr. John M. Arthur of the Boyce Thompson Institute, Yonkers, N. Y.

In one set of experiments plants were grown with daylight supplemented at night by a battery of forty-eight 1,000-watt incandescent lamps. In other experiments a similar series was grown entirely with artificial light using twenty-five 1,500-watt lamps as a light source. Both series were grown with and without additional carbon dioxide gas, Dr. Arthur stated.

Several plants, like the red clover, grow well with artificial light even under continuous 24-hour illumination. Most plants studied do not increase in weight of tissue produced on more than a 17 to 19-hour working day. A few plants such as the tomato will not withstand 24-hour continuous illumination.

Daylength effects are produced with artificial light very similar to natural daylight. Lettuce and radish flower on daylengths greater than 12 hours. Salvia flowers mainly on daylengths up to 15 hours. Buckwheat flowers on all daylengths from 5 to 24 hours.

The percentage composition of starches and sugars manufactured by the plants increases with daylengths usually up to a 19-hour working day. In a few plants it may increase up to a 24-hour day.

### Brain Workers Restless Sleepers

Middle aged men who are engaged all day in absorbing intellectual work are more restless sleepers than their wives who keep house and play bridge, according to Dr. H. M. Johnson, of the Mellon Institute of Industrial Research at the University of Pittsburgh.

A sleeper sinks to a state of minimum activity about 30 to 45 minutes after retiring, Dr. Johnson has found. For the rest of the night there is a regular wave-like alternation of stirring and quiet. The chart of an individual's activity pattern during sleep is, to a certain extent, characteristic of him. The curve of restlessness undergoes striking changes in anxiety and in different phases of some mental diseases.

# Chemistry of Fires, Drugs, Atoms, Sugars

## Chemistry

What is talked about when chemists get together is told in these reports of the St. Louis meeting of the American Chemical Society, April 16 to 19, written by Dr. Edwin E. Slosson and Watson Davis.

A blazing fire of burning gasoline in the parlor of the St. Louis headquarters hotel of the American Chemical Society was put out with a dash of water. The firemen were a couple of young chemists from Dayton, Ohio, Charles Allen Thomas and Carroll H. Hochwalt, the extinguisher was a new chemical mixture of their discovery, and the fire was a demonstration.

As every automobilist knows, or ought to know, water will not extinguish a gasoline flame but the secret of success in this spectacular demonstration was that a common salt of potassium was dissolved in the water. This new method of extinguishing oil fires is called a "catalytic effect" by the discoverers. Hitherto fire extinguishers have been based upon two well known principles, either smothering the fire by shutting out the oxygen of the air as by the use of carbon tetrachloride or cooling the combustible below the kindling temperature as by water. But the effect of this new form of fire extinguisher appears to depend upon the chemical composition of the salt dissolved in the water. The most efficient substances were found to be salts of the alkali metals, not merely potassium but still more the rare elements, rubidium and caesium. Salts containing an abundance of oxygen proved most effective. It is surprising to find chief among these chemical fire extinguishers potassium nitrate, which is an ingredient of gunpowder, and potassium chlorate which is employed in explosives. Among the useful substances in this scheme for fighting the flames were salts of acetic, the vinegar acid, butyric, the rancid butter acid, tartaric, the grape acid, and lactic, the sour milk acid. It is expected that aqueous solutions of some of these will be found useful in hand extinguishers for automobiles and garages and for automatic sprinklers for buildings where gasoline and oils are stored. The Underwriters Laboratory of Chicago report that the one and three-quarter gallon extinguisher is very effective on both oil and wood fires.

### Boosting Drugs

A new method of rendering drugs more potent against disease and at

the same time less harmful to the patient was demonstrated by Dr. M. L. Crossley, chemist of Bound Brook, N. J. Some magnesium salt is administered with the medicine. This seems somehow to energize the drug, perhaps by opening the doors of the system so as to let it enter and spread more freely through the body. At any rate it serves to reduce the dose and quicken the action in many cases. In reducing temperatures of fevers, in deadening pain or producing insensibility the effect of many medicines was doubled by employing magnesium as a booster. Aspirin for instance was twice as effective in combination with magnesium. A man racked with arthritis was relieved of pain within twenty-four hours. When morphin is used after an operation to prevent suffering the injection generally has to be repeated in about four hours but when magnesium was added the analgesic influence lasted for fifteen hours. Codein by itself has no antipyretic action but with magnesium is very effective in reducing the fever. Any compound of magnesium may be used.

### Pure Air

A call for a crusade for pure air following the fight for pure food and the fight for pure water was the main message of the presidential address of Prof. Samuel W. Parr. Over eighty per cent. of the fuels now in use are smoke producing. This is not merely a waste of combustible material but increases laundry bills, injures merchandise and impairs health by filtering out the ultraviolet rays of the sunshine with a smoke screen and by corroding the lungs with sulphur fumes. The domestic chimney is a worse offender than the factory. The supply of anthracite is inadequate but smoke can be equally well eliminated by converting bituminous coal to gas and coke or to some semi-coke combustible, a field in which Prof. Parr has conducted research at the University of Illinois for a quarter of a century.

The expansion and increase of efficiency in the use of power, said Prof. Parr, "is to be credited to the engineer whose strides can be readily noted in more scientific boiler settings, improved stokers, turbine engines, pulverized coal, superheaters,

economizers and high boiler pressures. One might think that the engineer had about reached his limit, but more likely he has just made a good beginning providing he calls in the chemist for cooperation in the next chapter."

### Pure Water

Pure water was credited with the reduction in the use of alcoholic liquors and the bringing about of prohibition in an address by Dr. William J. Mayo, the Rochester, Minn., surgeon, who spoke at the same session with Dr. Parr.

Explaining that European peoples had taken to wine and beer not for love of alcohol but because of lack of safe water, Dr. Mayo declared:

"Simultaneously with Vienna's introduction of a pure water supply from the mountains, her per capita consumption of spirituous and fermented liquors was reduced spontaneously forty per cent. The introduction of a pure water supply in the various states in our country has been followed by a temperance movement, and finally by prohibition.

"The drink habit was one of the many forms of protection resorted to by nature to save man from filth diseases which cause death, or that which is worse than death, intellectual deterioration.

"Prohibition outlawry is largely from the alien who comes from countries where water could not be used for drinking purposes and also, of course, from the dregs and froth of our own citizens."

### Lactic Acid History

How the course of American history was changed by a complex chemical reaction was explained by Dr. Mayo. The resistance of the South was strengthened and the Civil War prolonged two years by the skill of Stonewall Jackson in replacing lactic acid by glucose in the muscles of his ragged barefoot men when he marched his troops with unexpected rapidity in the region across the Potomac from Washington in defense of Richmond. Violent exertion produces an accumulation of lactic acid in the muscles and so causes fatigue but this was relieved by General Jackson who ordered his men after marching several hours to lie flat on the ground and relax for a few minutes. (Turn to next page.)

## Chemistry of Fire, Drugs, Atoms—Continued

Then their strength was restored by sugar and other carbohydrates from the sutler's wagons. With the clinkers thus out and their furnaces stoked with fresh food at intervals the Confederate soldiers could make forty miles a day and still be fit for fighting. This was before the days of nutritional physiology which nowadays gives us the reason for such practices and enables us to employ these principles in health and disease.

### Matter's Heart

The heart of matter, the muscles of the atom, is being attacked by chemists with projectiles traveling 10,000 to 12,000 miles a second in an attempt to discover its nature and provide new information and theory. Further industrial advances and a better understanding of the way in which the universe is put together are expected to result.

In making new drugs, dyes, and the multitude of other chemical compounds that have been so instrumental in revolutionizing the world we live in, chemists have been concerned with only the outside of the atom. There the electrons circle around the nucleus like planets around the sun. But the center or nucleus is also vitally important, Dr. S. C. Lind of the University of Minnesota declared. Although but one hundred thousandth of the whole diameter of the atom, the nucleus determines the identity of the chemical element. Change it and the element is transmuted. Smash it hard enough and there may be released enormous stores of energy that may blast the earth, some theories have contended.

So far only the lightest and simplest elements have been disintegrated by bombardment with the speedy alpha rays from spontaneously exploding radium. Through the use of millions of volts of electricity which it will soon be possible to produce, much more powerful and heavier particles will be thrown into atomic hearts with results that may startle the world.

Far beyond the reach of the microscope are atoms and electrons. Yet their flashing travels, wrecks and transmutations can be seen and put in the movies. Prof. William D. Harkins of the University of Chicago revealed that his experiments have recorded the tracks of a million atoms passing through a hundred thousand million atoms of air. With

all this traffic collisions are relatively few since only thirty sharp conflicts were recorded on the 100,000 photographs. The path of the atoms is made visible to the eye and camera by allowing the shooting to take place in a wet atmosphere. Each atom leaves behind it a trail of water vapor distinctly visible.

### New Liquid Fuels

The possibility of producing new liquid hydrocarbons by bombarding gases with radium rays and electricity was reported by Dr. Lind in another communication later in the meeting. By similar methods German chemists are reported to be attempting to produce lubricating oil, thus making that country independent of foreign petroleum.

### Fighting Tuberculosis

Cooperation of the biologist and chemist in research upon the fundamental nature of tuberculosis was declared by Dr. William Charles White of the U. S. Public Health Service to offer hope for new progress in combatting this and allied diseases. Large batches of germs, some of them containing thirteen trillion tubercle bacilli, have been subjected to accurate chemical analysis. Ten substances, each with definite effects upon the animal body, have been isolated from these germs. More than twenty organizations and laboratories are cooperating in the research. One part of the germ, the phosphatide fraction, was found to make cells grow rapidly and wildly as if they were a cancer. Leprosy, whose causative germ can not be distinguished microscopically from that of tuberculosis, is also being studied.

### Artichokes

A rival of the Irish potato, which will also compete in sugar production with the sugar beet and the sugar cane, was introduced to the chemists by Dr. Frederick Bates, sugar chemist of the U. S. Bureau of Standards, Washington. It is the Jerusalem artichoke long used in Europe for cattle feed, but in this country usually classed with the turnips in the minds of housewives. From these artichokes the manufacturer can obtain large quantities of an uncommon sugar, levulose, which is fifty per cent sweeter than cane or beet sugar. Since the artichokes can be grown with little hand labor and can be stored easily they promise to supplement or even replace beets as the raw material for sugar factories in the beet belts. Al-

though experimental work has shown that high yields of levulose can be obtained from the artichoke, a continuous commercial process of sugar extraction has not yet been perfected. A factory plant on a small scale is now being installed at Washington to solve this problem.

This is the second new sugar industry that Dr. Bates has helped establish through fundamental research work. Six years ago he showed corn products manufacturers how to make dextrose, corn sugar or pure glucose from corn, and now 150,000 tons a year are produced.

While studying the artichoke as a sugar-producing tuber, it was discovered that artichoke flakes or chips, flour, paste and other products can be made to compete with similar foods from potato, wheat, etc. It is claimed that diabetics can eat levulose sugar and products with little harm to their condition, although the ordinary sugars and starches are dangerous.

### Native Gums

New gums from native plants which may take the place of exotic products were reported by Prof. Ernest Anderson of the University of Arizona. The common mesquite bush of our southern deserts yields a mucilaginous material that is similar to gum arabic. The cholla tree cactus exudes from insect wounds in its skin drops of a substance resembling gum tragacanth.

*Science News-Letter, April 28, 1928*

## The Dangerous Period

*General Science*

L. L. WHYTE, in *Archimedes* (Dutton):

The supremely difficult task of the next hundred years will be to keep the mind of the race healthy and stable through a period of critical sensitiveness. We are in a transition stage of violent instability, of intense cruelty coupled with compassion (America), of blended love of liberty and need of discipline, of emotional religions and of wars—but we must hope that it will lead to some mode of life with greater inherent stability.

*Science News-Letter, April 28, 1928*

Automobile accidents in 1920-1926 increased 64 per cent. in north Atlantic states, 100 per cent. in middle western states, and 230 per cent. in southern states, according to statement from the Chamber of Commerce of the United States.

# Franklin's Scientific Society Still Active

General Science

Following are reports of the American Philosophical Society by James Stokley.

America's oldest scientific society, founded in 1727 by Benjamin Franklin at an informal gathering of his friends, held its annual meeting from April 19 to 21 in the same home that it occupied in pre-revolutionary days, when Franklin was president. This is the American Philosophical Society, whose meeting place is in historic Independence Square, in the same group of buildings as Independence Hall, where the Declaration of Independence was signed, and where the Liberty Bell is preserved. The meeting room itself is filled with paintings and other relics of former officers and members, back to Franklin's time.

As modern astronomers told of the latest discoveries in the exploration of the universe, there stood at one side the telescopes used by David Rittenhouse, pioneer American astronomer. With one of these he observed the transit of Venus that occurred in 1769 from a platform especially erected for the purpose almost under the windows of the meeting room. Seven years later this same platform was used when the Declaration of Independence was first read in public.

## The Center of the Galaxy

Travel with the speed of light at 186,000 miles a second, in the general direction of the constellation of the Scorpion, for about 52,000 years. Then you will be at the center of the Milky Way, or Galaxy, the stellar system of which the sun and all the stars that we ordinarily see, are part.

So announced Dr. Harlow Shapley, the director of the Harvard College Observatory.

The Scorpion now appears in the southeastern sky late in the evening, and is characterized by the bright star Antares. The light from Antares takes about 125 years to reach us, traveling some six million miles each year. So small is this compared to the distance of the solar system from the heart of the Galaxy that Antares is practically our next-door neighbor, in one of the outlying stellar suburbs.

Dr. Shapley has arrived at this startling conclusion by a study that the Harvard Observatory has been making of some interesting regions in the scorpion and the neighboring groups of Ophiuchus, the serpent car-

rier, and Sagittarius, the archer. These regions turn out to be the galactic center, though their identification as such is a by-product of other researches.

It is from the distribution of the globular clusters, vast spherical swarms of stars, that has come the best determination of the direction of the center of the Milky Way, says Dr. Shapley. But this is not the only basis for his belief. Counts made of faint stars by D. Frederick H. Seares, of the Mt. Wilson Observatory, confirm the determination. So do the distribution of new stars, the number and faintness of stars that vary their light regularly, and the motions of the stars in the region of the sun.

Another important fact has been revealed by the velocities of these stars. They show that, just as the earth revolves around the sun, the sun itself is revolving around the center of the Galaxy, with a speed that cannot yet be accurately determined. It is, however, between two and three hundred miles a second.

Whether there is a central "sun" at the center of the Milky Way, and around which the stars revolve is another question that cannot now be answered. Scattered throughout space, outside of the Galaxy and far beyond it, are numerous spiral nebulae. These are watch-shaped objects usually with a spiral structure. By recent work of Dr. Edwin P. Hubble, at Mt. Wilson, some of these have been proven to be swarms of stars, like that of the Milky Way itself. Many of them have a nucleus of bright material at the center, and it may be that our own Galactic system has such a nucleus at the center in the direction of Scorpio, Ophiuchus and Sagittarius. However, there are in these constellations, clouds of dark matter, that makes its presence evident only by its silhouette against the bright starry background. This would obscure the central nucleus, if there is one.

Dr. Shapley announced that the study which revealed these facts is still in progress, and that it will finally give more accurate figures. Already 300 new variable stars have been found, as well as several new star clusters.

## Star Distance Revelations

Observations of star distances made at the McCormick Observatory of the University of Virginia,

and the Allegheny Observatory, Pittsburgh, are furnishing the yardstick by which the size of the universe is being measured. So, Prof. Samuel A. Mitchell, director of the Virginia observatory, told the members of the American Philosophical Society.

Prof. Mitchell is the champion astronomical distance measurer. Personally he has determined the parallaxes, from which are derived the distances, of over 300 stars. At his observatory a total of 800 stars has been measured.

These parallaxes are determined in the same way that a surveyor finds the distance of a far-off mountain peak. From each of two stations, separated by a known distance, he observes the peak and the other station. Then, knowing the base and two angles of a triangle, the distance can be computed. In measuring the star distances the astronomer takes the diameter of the earth's orbit, 186 million miles, as the base line. Careful measurement of photographs of the stars made six months apart, when the earth is on opposite sides of the orbit, gives the parallax.

Though there are other methods of getting star distances indirectly, they all depend ultimately upon these "trigonometric" parallaxes, the speaker stated. Some of these indirect methods make use of the spectrum of the star's light when it is passed through the prisms of the spectroscope, or of the light changes of a peculiar type of variable star, or a study of the motions of a star across the sky.

Chiefly basing his results on the study of variable stars, Dr. Edwin P. Hubble, of the Mt. Wilson Observatory, recently found that the spiral nebulae, long-standing astronomical mysteries, were independent systems of stars, outside the "local" one of which our sun and the Milky Way are parts. The nearest spiral nebula, he estimates, is so distant that its light takes a million years to reach us.

However, these determinations also depend upon the parallax determinations, for if the nearer of these "Cepheid" variables are not at the distance that astronomers suppose, the error is even greater for the far-away ones in the nebulae. Prof. Mitchell revealed (*Turn to next page*)

## American Philosophical Society—Continued

that in cooperation with the Mt. Wilson Observatory, the McCormick Observatory has made the first of a series of plates to determine the distance of about 150 of these Cepheid variables.

"It will now be necessary," he said, "to wait for another eight or ten years before taking the second series, until the lapse of sufficient time interval to permit the determination of the proper motions with sufficient precision. The mind of the astronomer that contemplates with serenity the time of a million years does not fret in being forced to wait a paltry decade to complete his observations."

### Human Bulldogs

When a person with a broad face, projecting jaw, and sunken-in bridge of the nose is described as "bulldogish" the comparison is more than one based on mere superficial resemblances. In fact, both the human being and the bulldog have to blame their glands, probably the thyroid and pituitary, for their condition. Both are abnormal, the victims of what the physician calls "achondroplasia." So announced Dr. Charles R. Stockard, professor of anatomy at the Cornell University Medical College.

Dr. Stockard showed pictures of several types of human dwarfs. One was the cretin, due to a failure of the thyroid gland to function properly, and immediately improved and eventually cured by administering thyroid extract. Another type is entirely normal in proportions, but merely built on a smaller scale than ordinary persons. Finally, there is the achondroplastic dwarf, the human "bulldog" with the head and torso practically normal size but with the legs and arms unusually short.

The bulldog, especially the English bull, shows remarkably similar characteristics, examination of the glands after death show the same abnormalities, and the behavior of the man and dog is similar, for, he said, "the bull is the most stupid of all dogs." Dr. Stockard has also ascertained the cause of the facial characteristics. Inside the skull, at the base of the brain cavity, is a bone that, in normal individuals, does not become hard until about 22 years of age. Before that time it consists of cartilage and grows with the individual. In the achondroplastic dwarfs and dogs, this bone is hard at birth. It does not grow any larger and so there is nothing to push out the upper part of the face as the person grows. Other types of dogs, such as the dachshund, are the result

of similar abnormalities which have been cultivated by breeders, and Dr. Stockard is hopeful that by their study he can gain information of value in treating the disorders in humans.

### Three Century Old Cells

Half a century or more before the society was founded began the life of cells from an Arizona bean tree exhibited to the members by Dr. Daniel T. Macdougal. Dr. Macdougal is director of the Carnegie Institution's Desert Laboratory at Tucson. These are the oldest living cells known, he said. Though the big trees of California, for example, have ages estimated at thousands of years, this age refers to the tree as a whole. The individual cells of which the tree is composed are much younger, for they are continually renewed, but even in these redwoods there are cells whose age, as individual cells, runs into centuries. The bean tree that he has studied has produced the oldest cells so far found, with ages in excess of 250 years. The old cells are found in the pith, and also in the woody part, the same part of the tree that is used for lumber.

As there are even larger trees of the same species than those he has studied, he believes that there may be cells far older. In fact, he said, there is no reason why they should not continue to live indefinitely. So far he has not been able to determine exactly why these cells can live so much longer than those of common trees, but he has found that they contain ten times as much calcium or ash as in the oak or beech, for instance. Also, the space between the cells contains from two to fifteen per cent of carbon dioxide, a gas present in the air in smaller proportions.

### Life in a Cell

Dr. Edwin G. Conklin, professor of biology at Princeton, told of his researches which alter the usual conception held of cells of another kind. Working with the eggs cells of a primitive aquatic animal related to the sea-squirt, he has shown that the cell may be made to go through the complete life cycle of the animal and still remain a single cell. Ordinarily, after the egg cell is fertilized, the cell begins to divide into two, then into four, and so on, until in about 12 hours it has turned into a freely swimming tadpole. Then the metamorphosis begins to the adult form of the animal. Dr. Conklin has succeeded in making the nucleus of the cell divide and redivide many times, all within the

wall of a single cell. The nucleus is the "heart" of the cell—its center of activity. These nuclei behave like those of normally developed cells. Those that form in the region from which muscle tissue would ordinarily develop, for instance, are large, like muscular nuclei, those corresponding to the animal's primitive spine are small and transparent. And then, when the time comes for the metamorphosis to take place, these nuclei change like those in the normal animal.

### Vitamin in Cod's Eggs

Vitamin D, widely known as a preventive of rickets, may play an additional and equally important part in the normal development of the egg and the young, Dr. Alfred F. Hess of Bellevue Hospital announced.

Cod liver oil is one of the richest sources known of this vitamin used for the protection and cure of rickets, yet it is evident, said Dr. Hess, that this cannot be its function in the cod and other fish, the livers of which contain this factor in varying amounts.

Investigation of the problem showed that eggs of all fish, and hens' and snakes' eggs as well, contain the valuable antirachitic factor. Although present in the hen's egg, it does not occur in the livers of young chicks.

"In other words," explained Dr. Hess, "this 'vitamin' has been utilized and used up in the course of the development of the chick. The same is true in regard to fish. Although fish eggs are rich in the antirachitic factor, the fish fry are devoid of it. A consideration of all these data, together with others, makes it evident that the so-called antirachitic vitamin has one or more functions in addition to the protection and cure of rickets. It may have several functions. Evidently, however, one is closely associated with the normal development of the egg and of the young.

"Whether this fact can be applied to mammals is a question which has not been investigated."

*Science News-Letter, April 28, 1928*

Milk is richer in vitamin D when cows are fed on green pasture.

Some of the peach trees in Arizona canyons are descendants of trees planted by Spanish priests who brought the seed to America over 300 years ago.

# Wren Marriages Are Very "Modern"

*Ornithology*

BY MARJORIE MACDILL

Jenny Wren, the perky little termagant now setting up housekeeping in a thousand dooryards, is not the model of domestic virtue she has always been supposed to be.

The X-ray eye of modern science, that strips cherished illusions off almost everything, has penetrated the privacy of Jenny's matrimonial affairs and revealed that she is—rather fickle.

S. Prentiss Baldwin, of Cleveland, Ohio, one of the leaders in the development of bird banding in this country, has devoted the last twelve years to an intensive study of the house wren, that has left little about the life of the fresh little scold of the bird world to the imagination, from egg to parenthood.

Mr. Baldwin first took up the study of birds as a pleasant avocation but eventually became so interested in the affairs of wrendom that he now devotes all his time to them. As a result the Baldwin Bird Research Laboratory, about ten miles out of Cleveland, is one of the most unique and completely equipped places for the study of birds in existence.

Most bird lovers have the idea that the twittering couple who have recently taken possession of the neat box on the back yard fence are the same devoted ones who lived there last year. Mr. Baldwin's voluminous records, however, show that this pretty fallacy, as far as the house wren is concerned, has gone the way of most sentimental notions these matter-of-fact days. Wrens are ultra-modern in their domestic arrangements. In fact, Jenny Wren believes in divorce.

She not only changes her mate from season to season, but frequently raises one brood in the spring with one husband and another brood of nestlings later in the season with another. The deserted mate promptly consoles himself and philosophically sets about raising a second brood with a new helpmate. Sometimes Father Wren is the faithless one, leaving his wife to raise her brood as best she can alone. In any case individual heart throbs are not allowed to interfere with the serious business of raising a family.

This new light on the private life of wrens is based on the recapture and close personal observation of many individual banded birds. The rematings in wren families make it



THE HOUSE WREN is a devoted parent, but a very fickle spouse

Painting by L. A. Fuertes. © by Mabel Osgood Wright.

difficult to keep track of the family relationships. In three generations the services of a trained genealogist would be needed to tell which was whose uncle among the wrens in one limited locality.

The males arrive first at Hillcrest Farm, where the Bird Research Laboratory is situated. Each locates what he considers a satisfactory nesting box into which he starts dragging sticks, the preliminary makings of a nest. Here he takes up his stand, guarding the box against all rivals and lifting up his vociferous wrenish voice in well-nigh perpetual song. The females arrive a little later, look the ground over, and, like the more hard-boiled of their human sisters, have a sharper eye out for the material comforts the potential mate can offer than they have for the bird himself. For close observations have shown that the structure of the nest box and its location really arouses more interest in many females than the personal attractions of the mere male that goes with it.

In commenting on the "choosiness" of Jenny Wren in selecting her establishment, Mr. Baldwin relates the following instance of feminine bargain hunting in homes and husbands:

"For two or three weeks a male occupied a nesting box, No. 53, on the outside wall of the library at Hill-

crest. One morning he sang with unusual vigor and showed great excitement. A female was examining his nest box. At 7 A. M. the trapdoor of the box was closed and the band on the leg of the captured female was read.

"Four hours later, when the observer was passing nest box No. 47, attached to the walls of the garage, its male proprietor showed similar excitement over a female that was going in and out of the box and otherwise indicating that she was inspecting the premises. She was trapped and her band proved her to be the same bird noted earlier in the morning at box 53.

"At 4 P. M. on the same day she was caught at nest box 49, half way between the other boxes, where she was examining the premises held by a third male. By the next morning she had settled down contentedly and began her honeymoon with male number four (!) at box 26, attached to the outer walls of the sugar house. This was the final choice and there she raised her family."

Bird banding, the nation-wide practice which is just beginning to reveal to science some of the age-old secrets of bird migration, is the prop on which Mr. Baldwin and his assistants lean most heavily for their information about the private life of the wren. For one wren resembles another in looks, though not in character the wren student will tell you, as much as two peas in a pod. Father and Mother Wren look so much alike that not even a trained ornithologist can tell the sex of a wren held in his hand without recourse to dissection.

Two assistants, experienced ornithologists, assist Mr. Baldwin in banding and checking up on the hundreds of wrens at Hillcrest Farm. It is their job to keep all the numbered nest boxes and their inmates on a certain restricted area of the hundred-acre farm under observation from four o'clock in the morning, the wren rising hour, until the whole wren family retires to rest. Kindly treatment and freedom from cats and other annoyances have attracted such large numbers of wrens to the specially constructed nest boxes that seven acres are all that are included in the intensive survey. The nest boxes on the rest of the farm and neighboring estate are kept under a more general (*Turn to next page*)

## "Modern" Wren Marriages—Continued

observation by means of weekly inspection trips with the laboratory Ford.

The identification of the individual bird at Hillcrest is begun with the egg. The mother bird, inured by kindly treatment, will allow the human beings that she knows and trusts to take out her eggs to be measured, numbered and weighed to determine the rate of evaporation during incubation and then put back in place again. When the eggs have hatched the young birds are carried to the laboratory where their body temperature is taken. For this purpose a special thermometer has been devised

that is small enough to go down the avian throat. Surprisingly enough the nestlings take kindly to this instrument. Perhaps they think it is a new kind of angleworm.

Each nest box is numbered and a record kept of the band numbers of its master and mistress and the whole family. The bands are not put on the latter until the tenth day because the legs are too small for the regulation U. S. Biological Survey band until this time. It speaks volumes for the patience and dexterity of the workers at Hillcrest that practically no eggs or young birds have been

lost as the result of handling, in spite of the fact that the red tape the wren babies undergo after hatching compares favorably with that confronting a new-born infant in a modern hospital.

To aid the studies on incubation, an elaborate electrical device has been installed that tells just how much time Mother Wren spends keeping her eggs warm and how much time she takes off.

Thirteen minutes appears to be about the average length of the time she can stick on the job, but she seldom stays off longer than six minutes. Almost always she broods her eggs all night during the incubating period, though there is a record of one flighty female wren that went out for the evening at 8:50 P. M. and did not return until 1:04 A. M. During the last three days of the incubation period the absences are much less frequent but of about the same duration. The wrenograph, as Mr. Baldwin has christened this instrument, is an electrical apparatus that establishes electrical contact whenever the bird comes on the nest. It is connected with a self-recording device in the laboratory that shows at a glance whether the wren in Box No. 147, for instance, was on her nest at 7:30 last night and if she is there now or out taking a bit of lunch.

In addition to this a potentiometer that is connected with the electric-light circuit registers the temperature of the nest and eggs. A tiny wire stretched across the eggs that looks like a bit of thread is connected with another self-recording instrument in the laboratory that registers the temperature of the nest to within one degree Fahrenheit. Thus the observers can see just how far the temperature of the eggs falls each time the mother bird goes off the nest. This is probably the first time that such apparatus has been used in working out problems of the life history of birds. The data collected is being used to determine the adjustment in the nest to warm and cold spells outside during the incubation period.

The immense amount of data on the house wren that has been collected at the Baldwin Laboratory will eventually be used in a book on the life history of wrens that will tell for the benefit of ornithologists all the intimate details that Mr. Baldwin and his students have learned in the course of years of study.



S. PRENTISS BALDWIN has handled 30,000 wild birds in the last ten years without any of the birds suffering injury

## Classics of Science:

Assuming that the alloy in your ring is silver alone, you may find the proportion of gold to silver in your ring by the method Archimedes used in Hieron's crown. Divide the weight of your ring by 19.3, the specific gravity of gold, to find the apparent loss of weight in water if your ring were pure gold. Call this quantity  $F_1$ . Divide the weight of your ring by 10.5, the specific gravity of silver, to find the apparent loss of weight in water if your ring were pure silver. Call this quantity  $F_2$ . Find by experiment the actual loss of weight of your ring in water. Call this quantity  $F$ . Substitute in the equation:

$$\frac{w_1}{w_2} = \frac{F - F_1}{F_2 - F}$$

to find  $w_1$  and  $w_2$ , the weights of gold and silver respectively in your ring.

*THE WORKS OF ARCHIMEDES, On Floating Bodies, Book I. Proposition 7., Edited in Modern Notation with Introductory Chapters by T. L. Heath, Sc. D. Cambridge (England), 1897.*

### Weight in Water

*A solid heavier than a fluid will, if placed in it, descend to the bottom of the fluid, and the solid will, when weighed in the fluid, be lighter than its true weight by the weight of the fluid displaced.*

(1) The first part of the proposition is obvious, since the part of the fluid under the solid will be under greater pressure, and therefore the other parts will give way until the solid reaches the bottom.

(2) Let  $A$  be a solid heavier than the same volume of the fluid, and let  $(G + H)$  represent its weight while  $G$  represents the weight of the same volume of the fluid.

Take a solid  $B$  lighter than the same volume of the fluid, and such that the weight of  $B$  is  $G$ , while the weight of the same volume of the fluid is  $(G + H)$ .

Let  $A$  and  $B$  be now combined into one solid and immersed. Then, since  $(A + B)$  will be of the same weight as the same volume of fluid, both weights being equal to  $(G + H) + G$ , it follows that  $(A + B)$  will remain stationary in the fluid.

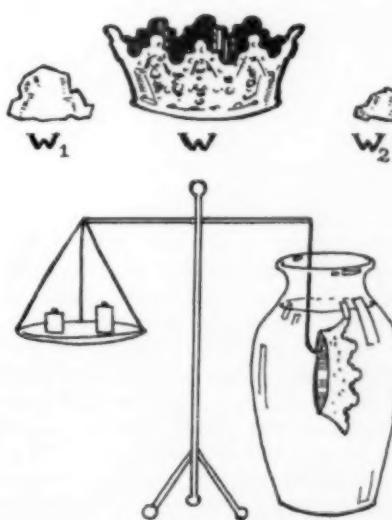
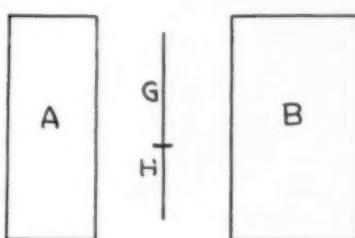
Therefore the force which causes  $A$  by itself to sink must be equal to the upward force exerted by the fluid on  $B$  by itself. This latter is equal to the difference between  $(G + H)$  and  $G$  [Prop. 6]. Hence  $A$  is depressed by a force equal to  $H$ , i.e. its weight in the fluid is  $H$ , or the difference between  $(G + H)$  and  $G$ .

### Hieron's Crown

[This proposition may, I think, safely be regarded as decisive of the question how Archimedes determined the proportions of gold and silver contained in the famous crown. The

## Weight in Air and Water

### Physics



*ARCHIMEDES' DIAGRAM* is shown in the upper part of the illustration. He represented the heavier body in his proposition by the area  $A$ , the lighter by  $B$ , and let the lines  $G$  and  $H$  stand for weights, as described in the quotation. The crown  $W$  in the more modern part of the picture is supposed to be made up of a weight  $w_1$  of gold and a less weight  $w_2$  of silver, which was the impurity that Archimedes had to determine.

proposition suggests in fact the following method.

Let  $W$  represent the weight of the crown,  $w_1$  and  $w_2$  the weights of gold and silver in it respectively, so that  $W = w_1 + w_2$ .

(1) Take a weight  $W$  of pure gold and weigh it in a fluid. The apparent loss of weight is then equal to the weight of the fluid displaced. If  $F_1$  denote this weight,  $F_1$  is thus known as the result of the operation of weighing.

It follows that the weight of fluid displaced by a weight  $w_1$  of gold is  $w_1 - F_1$ .

(2) Take a weight  $W$  of pure silver and perform the same operation. If  $F_2$  be the loss of weight when the silver is weighed (Turn to next page)

## Microsupersonics

### Physics—Biology

Super-sonic waves, which are rays of sound waves vibrating too rapidly to be heard, have now been brought under such control that observers can watch their effects through a high-power microscope. Using a small electrically driven crystal to produce these waves at a rate of 406,000 a second, Prof. E. Newton Harvey of Princeton University and Alfred L. Loomis of Tuxedo Park, N. Y., have watched blood corpuscles warp, twist and disintegrate, and have seen the living protoplasm in plant cells whirl in a dance of death, faster and faster until it has separated into spinning bits, broken and disorganized.

The apparatus used in these experiments is a refinement, on almost a jeweler's scale, of an earlier form devised by Mr. Loomis and Prof. R. W. Wood of the Johns Hopkins University. It takes advantage of the fact that when a rapidly alternating electric current is fed into a quartz crystal cut in a certain fashion, the crystal vibrates at the speed of the electrical oscillations, producing sound waves. By cutting the crystal small, and using an electrical oscillator of the type employed in radio stations, it is possible to produce sound waves twenty times as fast as the 20,000-per-second ones which represent the upper limit of human hearing ability. And these extremely rapid waves, at high enough intensities, have a tearing, killing effect on living substance. They have been nick-named "the death whisper."

"Observing under a high power microscope," Prof. Harvey and Mr. Loomis state, "it has been possible to follow the progressive destruction of frog blood corpuscles. The oval cells at first become warped and twisted. Strained areas appear and the color fades, leaving a pale distorted shadow. Human blood corpuscles are likewise twisted and sometimes broken up into many small globules like an emulsion of oil."

The two scientists also tried the vibrations on the leaves of a water plant, in which the living protoplasm usually keeps up a constant circulation around the wall of each cell. "High frequency waves of low intensity passed through these cells cause the protoplasm to rotate very much as in the normal rotation," they state. "Increasing the super-sonic intensity (Turn to next page)

## Microsupersonics—Cont.

increases the movement until the whole cell is a rapidly whirling mass of protoplasm, fragments of which are torn loose and rotate as small balls in the vacuole. The effect is very striking.

"The microscopic method offers a promising means of attack upon the problem of influencing the development of eggs of various species, as forces can thus be applied inside an egg at different stages of its development without the necessity of puncturing the cell wall or enveloping membrane. The results immediately suggest the interesting possibility of converting an egg with determinate cleavage into an indeterminate one by thoroughly mixing and redistributing the organ-forming substances of its interior."

*Science News-Letter, April 28, 1928*

## Importance of Roots

*Plant Ecology*

JOHN E. WEAVER AND WILLIAM E. BRUNER, in *Root Development of Vegetable Crops* (McGraw-Hill):

In considering the importance of root relations in crop production, it should be clearly kept in mind that the plant, the soil, and the climate, form a closely interlocking system of which no part should be overlooked or over-emphasized. It is now rather generally recognized that climate and vegetation are the most important factors determining the character of the mature soil. "The features assumed by the soil in its development from infancy, through youth, maturity, and old age, vary with the environment, especially with the climate and the vegetation." The effect of both climate and soil on the growth of aboveground plant parts has long been known. It has only recently been clearly demonstrated that the environmental factors which affect the root are not only those of the soil immediately about it but also those affecting the shoot which is rightly a part of the complex. Through the shoot the root system is influenced by the aerial environment. The amount of light or the degree of humidity, temperature, etc., and the effect of these upon food manufacture, water loss, and other activities affect root development. In fact there is a rather close correlation between shoot and root development. Whatever affects the aboveground growth of plants whether favorably or unfavorably is, in turn, very likely to exert an influence upon root development.

*Science News-Letter, April 28, 1928*

## Weight in Air and Water—Continued

in the fluid, we find in like manner that the weight of fluid displaced by

$$w_2 \text{ is } \frac{w_2}{W} \cdot F_2.$$

(3) Lastly, weigh the crown itself in the fluid, and let  $F'$  be the loss of weight. Therefore the weight of fluid displaced by the crown is  $F$ .

It follows that

$$\frac{w_1}{W} \cdot F_1 + \frac{w_2}{W} \cdot F_2 = F,$$

or  $w_1 F_1 + w_2 F_2 = (w_1 + w_2) F$ .

$$\text{whence } \frac{w_1}{w_2} = \frac{F_2 - F}{F - F_1}.$$

This procedure corresponds pretty closely to that described in the poem *de ponderibus et mensuris* (written probably about 500 A.D.) purporting to explain Archimedes' method. According to the author of this poem, we first take two equal weights of pure gold and pure silver respectively and weight them against each other when both immersed in water; this gives the relation between their weights in water and therefore between their loss of weight in water. Next we take the mixture of gold and silver and an equal weight of pure silver and weigh them against each other in water in the same manner.

The other version of the method used by Archimedes is that given by Vitruvius, according to which he measured successively the volumes of fluid displaced by three equal weights, (1) the crown, (2) the same weight of gold, (3) the same weight of silver, respectively. Thus, if as before the weight of the crown is  $W$ , and it contains weights  $w_1$  and  $w_2$  of gold and silver respectively,

(1) the crown displaces a certain quantity of fluid,  $V$  say,

(2) the weight  $W$  of gold displaces a certain volume of fluid,  $V_1$  say; therefore a weight  $w_1$  of gold displaces a volume of  $\frac{w_2}{W} V_1$  of fluid.

(3) the weight  $W$  of silver displaces a certain volume of fluid, say  $V_2$ ; therefore a weight  $w_2$  of silver

displaces a volume  $\frac{w_2}{W} V_2$  of fluid.

It follows that

$$V = \frac{w_1}{W} \cdot V_1 + \frac{w_2}{W} \cdot V_2.$$

whence, since  $W = w_1 + w_2$ ,

$$\frac{w_1}{w_2} = \frac{V_2 - V}{V - V_1};$$

and this ratio is obviously equal to that before obtained, viz.  $\frac{F_2 - F}{F - F_1}$ .

**Archimedes** was born about 287 B. C., and was killed in 212 B. C. by a Roman soldier during the sack of Syracuse. He was the son of Pheidias, a Syracusan astronomer. He spent some time in Alexandria, then one of the principal seats of learning of the world. While there he is said to have invented a water-screw, which was used in the irrigation system of Egypt. After returning to his native city, Archimedes devoted himself to the study of problems in mathematics and physics with such concentration that he would often forget to eat. Any handy material served him for drawing his diagrams, even the ashes in the fireplace or the oil upon his body when he bathed. He was an intimate friend of King Hieron and his son Gelon, and dedicated some of his books to them. The problem of finding out whether a new crown was pure gold or adulterated with silver was given him by Hieron, and Archimedes got the clew to the method by seeing the water-level rise when he entered the bath. He jumped out and ran through the streets, shouting: "Eureka!" Levers also engaged the philosopher's admiration, causing him to exclaim: "Give me a place to stand on, and I can move the earth!" His book "On Levers," however, is lost. Archimedes constructed many scientific toys, one of which, an astronomical sphere showing the motions of the sun, moon and five planets in the heavens with such accuracy that it would illustrate the eclipses, survived to the time of Cicero, who saw and described it. During the siege of Syracuse, Archimedes devised catapults and other engines of war, which terrorized the besieging Romans. The Romans were, nevertheless, successful. After the capture of the city, Archimedes was sitting as usual before his sand table, working out a diagram, oblivious to what was going on about him, when he was run through the body by the sword of a Roman soldier. Some say that the soldier was annoyed because Archimedes asked him to step out of the light. Marcellus, commander of the Roman forces, seems to have grieved that one of his men inadvertently killed the greatest mathematician of his time.

*Science News-Letter, April 28, 1928*

## The Magic Box

*Mathematical Physics*

W. R. BAKER, in *Harper's Magazine*:

Length, breadth and depth are said to be

The limits of man's comprehension,

But when I see the pile of junk

That she can get into a trunk

The mystery convinces me

That woman knows a fourth dimension.

*Science News-Letter, April 28, 1928*

Minnesota ranks first among the states in production of potatoes.

## First Glances at New Books

PROCEEDINGS OF THE WORLD POPULATION CONFERENCE—Edited by Mrs. Margaret Sanger—*Edward Arnold & Co.* A summary of the papers and discussions at the recent conference to determine how this geographically limited earth can best grapple with the problem of supporting its population.

*Sociology*

*Science News-Letter, April 28, 1928*

WHY MEN FAIL—Edited by Morris Fishbein and William A. White—*Century* (\$2). Psychiatrists, physicians, psychologists, nerve specialists and sociologists have analyzed human failure from their respective angles.

*Sociology*

*Science News-Letter, April 28, 1928*

MORTALITY STATISTICS, 1925, Part I—*Government Printing Office* (\$2). Causes of death are recorded from many angles in the 455 pages of statistical tables that make up this volume of the census report.

*Sociology*

*Science News-Letter, April 28, 1928*

PRESIDENTIAL YEARS, 1787-1860—Meade Minnigerode—*Putnam*. A sprightly account of presidential elections up to the time of the Civil War, embellished with several interesting prints and illustrated covers of long-forgotten campaign songs.

*Politics*

*Science News-Letter, April 28, 1928*

THE BEHAVIOR OF THE MUSEUM VISITOR—Edward Stevens Robinson—*American Association of Museums*. An experimental study by a Yale professor of psychology on the cause of "museum fatigue" and how to relieve it.

*Psychology*

*Science News-Letter, April 28, 1928*

PSYCHIC RESEARCH—American Society for Psychical Research—*Hyslop House*, New York (\$50). The first issues of the Journal of the American Society for Psychical Research in its new and attractive form of a monthly magazine contain reports of a pony who apparently knows Greek and geometry, the thumb prints of Margery's spirit brother and many other marvels.

*Psychology*

*Science News-Letter, April 28, 1928*

AN ABORIGINAL SALT MINE AT CAMP VERDE, ARIZONA—Earl H. Morris—*American Museum of Natural History*. A description of one of the most extensive of Indian salt workings, and of artifacts found in it.

*Archaeology*

*Science News-Letter, April 28, 1928*

SUPPLEMENTARY NOTES ON THE QUIPUS IN THE AMERICAN MUSEUM OF NATURAL HISTORY—L. Leland Locke—*American Museum of Natural History*. Technical descriptions of the strange string-mnemonics of Peru.

*Archaeology*

*Science News-Letter, April 28, 1928*

FUR FARMING FOR PROFIT—Frank G. Ashbrook—*Macmillan* (\$4). A much needed account of one of our most interesting and newest industries. Though intended as a practical volume for those who wish to go into fur-farming as a business venture, everybody interested in animals or furs will find it worth while.

*Zoology*

*Science News-Letter, April 28, 1928*

ELECTRICITY ON THE FARM AND IN RURAL COMMUNITIES—Committee on the Relation of Electricity to Agriculture, (1120 Garland Bldg., Chicago.) (\$50). A 1361-page bulletin, 210 illustrations, 83 tables, giving data and other information on 100 rural uses for electricity. A digest of all information on the subject of rural electrifications at the command of the Committee on the Relation of Electricity to Agriculture.

*Electricity*

*Science News-Letter, April 28, 1928*

THE CHEMICAL EFFECTS OF ALPHA PARTICLES AND ELECTRONS—Samuel C. Lind—*Chemical Catalog* (\$5). The second (revised and enlarged) edition of a standard work on what radium rays do when they hit certain substances.

*Physical Chemistry*

*Science News-Letter, April 28, 1928*

METHODS, FORMULAS AND TABLES FOR THE CALCULATION OF ANTENNA CAPACITY—Frederick W. Grover—*U. S. Govt. Prtg. Office* (\$20). A scientific paper of the Bureau of Standards, in which methods of calculation of antenna capacity are discussed and tables given for determining without calculation the capacity of antennas of the most common types; viz., single wire vertical and horizontal and two wire horizontal.

*Physics*

*Science News-Letter, April 28, 1928*

THE JOURNAL OF BUSINESS—*Chicago Press* (\$4 per year). The first number of the first volume of a new quarterly publication devoted "to the scientific and professional interests of business."

*Economics*

*Science News-Letter, April 28, 1928*

## NATURE RAMBLINGS

BY FRANK THONE

*Natural History*



**Wombat**

In Australia's remarkable zoo, which out of two very lowly original zoological ancestral stocks has furnished forth animals resembling wolves, weasels, anteaters and a number of others, besides the utterly original and fantastic kangaroos, the Wombat is one of the oddest and yet most familiar-appearing.

The wombat is what might be called a marsupial bear. He has a long, thick, burly body mounted on short, stubby legs, a blocky head with beady little eyes, and round, blunt ears. He reaches a maximum length of about three feet.

The wombat is a most complete vegetarian. He feeds on grass stems and softer herbage, and has an especial weakness for fleshy roots. Occasionally he raids gardens, though as a rule he is a gentleman and lets other folks' property alone.

The wombat is a good family man. He digs a long, sloping tunnel that terminates in the domestic den. Here Mrs. Wombat devotes herself to her offspring, of which she produces but one at a birth. Like all her marsupial kindred, she has a maternal pouch in which to carry the youngster while it is still in the imperfect and helpless stage of development—for all marsupial infants are, so to speak, born prematurely.

As a domestic pet the wombat shines. Its very name has something fantastic and sportive about it, although it is only the sober and unimaginative appellation given the animal by the black natives of Australia. Being rather stupid, as most marsupials are, it is very good-natured, and will stand a lot of pulling and hauling. Being sturdily built it can survive the rough treatment children give their pets. Being a vegetarian it is not hard to feed. Happy is the Australian or Tasmanian family that can boast its house-wombat.

*Science News-Letter, April 28, 1928*

## A Statement of Purpose

(The aims, ideals and aspirations of an institution)

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In a democracy like ours it is particularly important that the people as a whole should so far as possible understand the aims and achievements of modern science, not only because of the value of such knowledge to themselves but because research directly or indirectly depends upon popular appreciation of its methods. In fact the success of democratic institutions, as well as the prosperity of the individual, may be said to depend upon the ability of people to distinguish between science and fakes, between the genuine expert and the pretender.

Science Service spares no pains or expense in the endeavor (1) to get the best possible quality of popular science writing and (2) to get it to the largest possible number of readers. If in doing this it can make both ends meet, so much the better. If not, it will do it anyway.

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Science Service began its work on January 1, 1921, and has now a sizable office staff with a large corps of contributors in the chief research institutions of this country and Europe.